

A SPECIES OF FERUSSACIA IN SOUTH AUSTRALIA

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Since Quoy and Gaimard, in 1824, published the first record of European slugs (*Limax maurus* = *Milax gagates* and *Limax megalodontes* = *Limax flavus*) in South Australia, several authors have recorded new intruders.

In his Presidential Address, delivered at the annual meeting of the Malacological Society of London, 9th February, 1952, Dr. H. E. Quick gave a survey of the literature on that subject and published a list of fifteen western European land molluscs introduced into Australia and Tasmania.

In 1954 B. C. Cotton published his Catalogue of the introduced snails and slugs in Australia, and mentions 35 species, most of which inhabit the Mediterranean and western European areas.

Dr. H. E. Quick kindly sent me some specimens of one of these adventive molluscs collected in the summer of 1953 by Mr. B. C. Cotton, who, later on, was good enough to send me some more material.

The species was first seen in great numbers during July and August of that year at Verdale Avenue, Linden Park, an eastern suburb of Adelaide, within four miles of the centre of the city. They were in very damp places, under the bricks, old cement bags, etc., on a block of land on which the foundations and walls of a new house had been built. The animals were active, apparently prolific, and, if disturbed, rapidly moved from light to seclusion.

In January of the same year the undergrowth of the building block was burnt off; only a few small olive trees, so common in the district, where they were originally introduced some hundred years ago by early colonists, probably from Italy, were growing there, and at the time of the find a thick growth of grass covered the ground without any unusual weed. No clue could be found as to how the snails came there. Mr. Cotton assures me that only locally-made cement, bricks, steel window frames and no imported materials have been brought to the blocks, so that it seems most likely that some specimens of this small species, like several other Mediterranean species, which have been imported into Australia from time to time, were introduced with trees or plants. If they were imported with the olive trees growing there, they must have lived and multiplied on a quarter of an acre since early times, and been overlooked until the summer of 1953, which possibility is hardly acceptable. There are no records of the species from other localities in Australia, and since then the snails disappeared from the scene as suddenly as they turned up.

It is quite certain that the specimens from South Australia belong to the genus *Ferussacia* Risso, 1826, *sensu stricto*. According to Cotton (1954, p. 185), H. E. Quick, after examining some specimens of the lot, came to the same conclusion, and Cotton (1954, p. 184) described the species under the name of *Ferussacia folliculus* (Gronovius, 1781).

I am, however, not convinced that the specimens, a number of which are listed in my collection under No. 7372, belong to the true *Ferussacia folliculus* (Gron.) because they seem to differ from a number of specimens described as such in many respects.

Numerous forms of the genus *Ferussacia* Risso, 1826, are known from the Mediterranean area, as well as from the European and African main-

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lands, and from the Canaries, Madeira and other western Mediterranean islands. Thiele (1931, pp. 547 and 548) divided the genus into five subgenera, and the subgenus *Ferussacia* s.s., to which our specimens belong, into two sections: *Ferussacia* s.s., of which the type species is *Ferussacia gronoviana* Risso, and of which representatives are indigenous in the Mediterranean area and on the Canary Islands, and the section *Pegea* Risso, 1826, which is limited to North Africa only, and of which the type species is *Ferussacia* (*Pegea*) *carnea* (Risso).

Because of the form of the shell, the shape of the aperture and the armament of the columella, the South Australian specimens have to be classed in the first-named section, to which also the species *Ferussacia folliculus* (Gron.) belongs.

Even of the section *Ferussacia* s.s. many forms have been described, but there is, however, such a great variability in shape and measurements of the shells, even in the same species, that it seems for the present impossible to make out with reliable certainty how many really distinct species there are.

Nevill (1880) pointed out this fact, and after him Watson (1928), Odhner (1931), Soos (1933), Wachtler (1935) and several other authors came to the same conclusion.

To form an idea of the variability of the representatives of the genus I give here a list of some allied species with their mean measurements and indices, as mentioned by some of the principal authors.

	Height of Shell in mm.	Maj. Diam. of Shell in mm.	Index
<i>F. folliculus</i> (Germain, 1930)	8-9	2.75-3	33-34
(Odhner, 1931)	10.5	3.6	34
	10.0	3.7	37
	9.0	3.0	33
	9.0	3.6	40
<i>F. vescoi</i> (Soos, 1933)	8.4	3.2	38
	9.1	3.3	36
	10.1	3.6	36
(Germaine, 1930)	9.0	4.0	44
<i>F. abromia</i> (Germaine, 1930)	11.0	4.0	36
(Bourguignat, 1864)	11.0	3.5	32
<i>F. amblya</i> (Nevill, 1880)	8.5	4.0	47
<i>F. barclayi</i> (Pfeiffer, 1855)	9.0	4.0	44
(Pilsbry, 1908)	8.6	3.5	41
	10.0	4.0	40
	8.3	3.5	42
<i>F. gronoviana</i> (Germain, 1930)	7.0	3.25	46
(Nevill, 1880)	10.0	3.75	38
	9.0	3.75	42
<i>F. gronoviana</i> f. <i>subamblya</i> (Nevill, 1880)	8.25	3.3	40
<i>F. gronoviana</i> f. <i>subfolliculus</i> (Nevill, 1880)	9.0	3.5	39
<i>F. gronoviana</i> f. <i>subforbesi</i> (Nevill, 1880)	8.25	3.25	39
	8.5	3.5	41
	7.75	3.0	39

The measurements of the South Australian specimens are as follows:—

Height in mm.	Maj. Diam. in mm.	Number of Whorls	Index
9.0	3.7	5½	41
9.0	3.7	5½	41
9.0	3.6	5½	40
8.6	3.8	5½	44
8.6	3.7	5½	43

On account of the circumstances mentioned above, and of the great uncertainty concerning the boundaries between the diverse species, varieties and races, it is for the present quite impracticable even to make an attempt to come to a conclusion regarding the identity of the very few specimens available from South Australia.

Though this is also the opinion of Dr. E. H. Madge, Director of the Victoria Hospital at Quatre Bornes, Mauritius, who kindly compared my specimens with as many lots of *Ferussacia* as he could find in the British Museum in London, and also of Dr. G. Ranson, Vice-Director of the Malacological Museum in Paris, who compared them with the lots of *Ferussacia* in the Paris Museum, I will refer to the following facts:—

In the middle of the nineteenth century Sir D. Barclay found in the Isle of France (Mauritius) a species, which Pfeiffer (1855), in honour of the discoverer, described under the name *Spiraxis barclayi*.

Nevill also found the species even before 1870, for Semper mentions in that part of his *Reisen im Archipel der Philippinen*, which was published in that year, that he received from Nevill a shell under the name of *Glandina vericulata* Benson, which Pilsbry (1908, p. 233) asserts to be a synonym of *Ferussacia barclayi*. Semper, however, did not say where the specimen was found, but he gives a not very detailed description of the jaw and the radula, without figuring the shell or the described organs.

In visiting Mauritius in 1878, Nevill came again upon specimens of the same species, and even found a sinistral example. According to Pilsbry (1908, p. 233), who first figured the species, it appeared to belong to the genus *Ferussacia*, and was probably an introduction from southern France. It differs from *Ferussacia folliculus* (Gron.) (i) by its slightly more ventricose last whorl, and, in accordance, by its somewhat wider aperture. Pilsbry's figures 66, 67 and 70 agree very well with the majority of our specimens.

It is uncertain whether, at present, the species is still living on Mauritius. Dr. Madge, who made extensive collections on the island, assures me that he has never found it. He compared my specimens also with those found by Nevill on Mauritius and at present in the British Museum, and came to the conclusion that at least four specimens of my lot agree very well with *Glandina vericulata* = *Ferussacia barclayi*. The other specimens agree pretty well with specimens from Spain labelled by Tomlin as *Ferussacia vescoi* (Bourguignat). The Australian specimens are somewhat more bulging

(i) Germain (1930, p. 322) wrongly changed the name to *Ferussacia follicula*. This is incorrect, because *folliculus* is a substantive signifying "a little grain," and not a declinable adjective.

than is generally the case in *Ferussacia folliculus*, and the columella is internally twisted as in *Ferussacia vescoi* and *F. barclayi*.

Mr. Ranson agrees with Dr. Madge as to the first four specimens, but feels sure that the other ones are true *Ferussacia folliculus* (Gron.), not *Ferussacia* (Bourg.), which he thinks to be a true species and not a variety of *F. folliculus*. Therefore, it is quite possible that our specimens have not been introduced into South Australia directly from the Mediterranean area, but via the intermediate station of Mauritius.

Even after a thorough anatomical investigation of a number of species neither Moquin-Tandon (1855), who studied the anatomy of *Ferussacia folliculus* (Gron.), nor Godwin Austen (1880), who investigated anatomically *F. gronoviana* Risso, nor Watson (1928), who studied the anatomy of *F. folliculus* (Gron.) and *F. oranensis* (Bgt.), nor Soos (1933), who dissected *F. vescoi* (Bgt.), nor Wachtler (1935), who investigated the anatomy of *F. folliculus* (Gron.), *F. reissi* (Mart.), *F. lanzarotensis* (Mouss.) and *F. vescoi* (Bgt.) could come with certainty to a reliable conclusion concerning sharp differences between them, though sometimes slight differences between some organs were established.

Probably many of what hitherto have been considered separate species will finally appear to be only ecological forms of one of two true species.

Our final conclusions must be, for the present, that, without a very extended taxonomical, anatomical, biological and ecological comparative investigation, it is as yet impossible to settle the question entirely.

Nevertheless, it seems to me subservient to later investigations, if I record here some of my experiences in dissecting the animals from South Australia.

According to some authors, the skin of the various species of *Ferussacia* seems to have a specific coloration, varying from greyish to yellow or green. However, as they had been in alcohol so long, nothing could be seen of this external coloration or of the pigmentation of the internal organs in my Australian specimens.

As is generally the case in the sub-family, *Ferussaciinae*, the relatively long and small foot shows a well-marked pedal fringe as well as a conspicuous suprapedal groove, and a well-developed mucous pore at a short distance from the caudal end.

The jaw (Fig. 1) is aulocognath, very thin and elastic, and of a yellowish colour. It has a number of narrow, smooth longitudinal folds or ribs, which converge posteriorly, and of which the central ones (about eight) touch each other on an imaginary median line. In the literature I could not find any special note concerning this peculiar course of the folds, though Watson (1928) figures converging striae to a certain extent for *F. oranensis*, and also to a small degree for *F. folliculus*.

According to Watson (1928), the jaw of *F. oranensis* has 48, and of *F. folliculus* only 42 folds. Wachtler (1935), however, counted 48-69 folds in the jaw of *F. folliculus*, whereas he found in *F. vescoi* 48-52, and in *F. reissi* 44 folds. Soos (1933) found in his specimens from the Maltese Islands, which he considered to belong to *F. vescoi*, and of which he states

that the jaw is exactly as in *F. gronoviana*, about 40-50 folds. In our specimens I counted a number of 48, 50 and 64 folds.

Watson (1928) gives for *F. folliculus* a breadth of 0.75 mm., and for *F. oranensis* a breadth of 0.65 mm. The breadth of the jaw in our specimens is about 0.90 mm., and the height in the middle part about 0.30 mm.

I have investigated the radulae of seven specimens, and found the following details:—

Transverse Rows	Formula	Length in mm.	Breadth in mm.
77	25-12-1-12-25	1.6	0.6
88	21-12-1-12-21	1.7	0.5
87	25-12-1-12-25	1.6	0.7
90	26-12-1-12-26	1.6	0.7
87	26-12-1-12-26	1.6	0.6
80	25-12-1-12-25	1.5	0.6
85	25-12-1-12-25	1.7	0.7

The course of the transverse rows is shown in fig. 2.

The central tooth is about the same length as the adjacent teeth on each side of it, but very much narrower, the length being about 0.025 mm. and the breadth about 0.007. At its front edge it bears three small blunt cusps, of which the middle one is slightly longer than the side ones.

The first twelve teeth on either side of the central tooth have well-developed bases provided with three more or less sharply-pointed cusps, of which the middle one is very powerful and much longer than the adjacent side cusps. Towards the outer edges of the radula they diminish in length and breadth; the bases gradually become comparatively more powerful, whereas the cusps diminish in size, the mesocones more rapidly than the side cusps. In the first teeth on either side of the central tooth the middle cusp is about four times as long as the side cusps, in the seventh lateral teeth the mesocone is still three times as long as the side cusps, whereas in the twelfth lateral teeth the ratio is not more than 2:1.

From about the thirteenth tooth on each side of the rachis there is a row of very small marginalia, which continue to diminish in size gradually towards the outer edges of the radula, and, apart from the very minute projecting cusps at the base, have the form of small rectangles closely placed side by side.

The central and lateral teeth of the successive transverse rows overlap each other, but towards the outer edges of the radula the overlapping gradually diminishes, so that in the outermost parts the marginals of the successive rows are fully detached.

The genitalia (figs. 4-7) are quite simple.

The albumen gland (about 1.5 mm. long) is rather large at its anterior end and narrowing distally; the hermaphrodite gland consists of a number of small oblong follicles opening into the very narrow hermaphroditic duct, which is at first straight and then slightly convolute in its distal third.

The rather long female left side of the spermoviduct (about 5 mm.) is swollen in most of the specimens, and contains a number of very little

eggs, which increase in size towards the front. The male right side is furnished with a comparatively small, though well developed, prostatic gland consisting of a number of single glands.

The vas deferens leaves the spermoviduct at about the same level as the anterior end of the receptacular duct, so that the free oviduct is extremely short. The unbranched receptacular duct is rather broad and long (about 3.5 mm.) and arises from a well-developed oval spermatheca; its anterior third shows a conspicuous widening in the middle.

The vagina is about 1.5 mm. in length and slightly narrowing towards the anterior end, where it passes into a genital atrium of moderate length and diameter.

The vas deferens is long (about 4.5–5 mm.) and narrow throughout its length, though slightly broadening apically; it winds around the vagina and enters the apical part of the penis just below or at the insertion of the penial retractor muscle, which is simple and attached to the dorsal body wall.

The penis is broad and comparatively short, its length being only about 1.5 mm.; it consists of a cylindrical main penis, which is somewhat narrowed, or even strangulated in the middle part, and a small muscular lateral penial appendage. Though in the specimen of fig. 5 the penial appendage is directed backwards and in that of fig. 6 it is also directed backwards in some degree, I think that the original direction of the appendage, if fully extended, is forwards. The specimen drawn in figs. 4 and 7 appeared to show the fully extended penial appendage, and this is directed forwards. In the specimens drawn in figs. 5 and 6 the appendage is more or less contracted, and in consequence assumes a more backward position. The specimen of *Ferussacia folliculus* examined by Watson (1928) and drawn in his fig. 10 shows the penial appendage directed sideways and partially invaginated, but I should not be astonished if that peculiar position is due to contraction as well.

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Fig. 1.
Ferussacia sp. from South Australia.
Jaw. (Coll. Venmans, Nr. 7372, 2.)



Fig. 2.
Ferussacia sp. from South Australia.
Course of the transverse rows of the
radula. (Coll. Venmans, Nr. 7372.)



Fig. 3.
Ferussacia sp. from South Australia.
Radula, central and first lateral,
7th and 13th teeth. (Coll. Ven-
mans, Nr. 7372.)

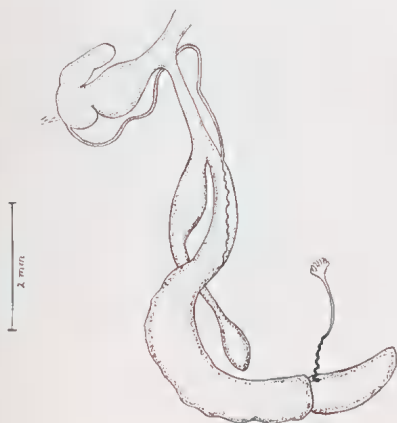


Fig. 4.
Ferussacia sp. from South Australia.
Male and female genitalia of one
of the specimens. (Coll. Venmans,
Nr. 7372, 1.)



Fig. 5.
Ferussacia sp. from South
 Australia. Male and
 female genitalia of one of
 the specimens. (Coll.
 Venmans, Nr. 7372, 2.)

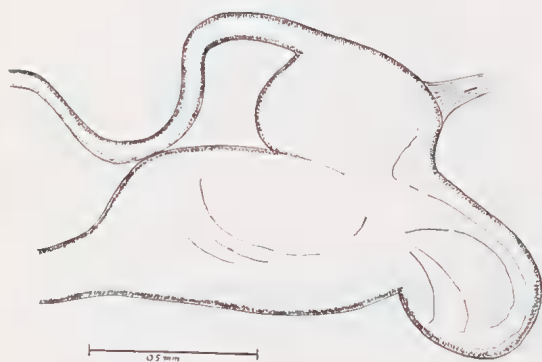


Fig. 6.
Ferussacia sp. from South
 Australia. Penis of one of
 the specimens. (Coll.
 Venmans, Nr. 7372, 3.)



Fig. 7.
Ferussacia sp. from South
 Australia. Penis of the
 same specimen as Fig. 4,
 strongly enlarged. The
 cavity of the penial ap-
 pendix is seen through the
 transparent wall. (Coll.
 Venmans, Nr. 7372, 1.)